REMARKS/ARGUMENTS

Reconsideration and allowance in view of the foregoing amendment and the following remarks are respectfully requested.

Claim 1 has been amended above to incorporate the limitations of dependent claim 16 and claim 16 has been canceled. Claim 15 has been presented in independent form. Accordingly, enter of this amendment as raising no new issues is respectfully requested.

Claims 1, 3-5, 12-14 and 16 were rejected under 35 USC 103(a) as being unpatentable over Yamada. Claim 16 was rejected over Yamada in view of Sato. Applicant respectfully traverses these rejections.

The present invention is based on a finding that in a particular application, such as recited in claim 15 (inside a surge tank) or as previously recited in claim 16 and now recited in claim 1 (inside an exhaust manifold of a diesel engine), the air-fuel ratio sensor may cause a lean shift due to the presence of unburned gas, which causes it to fail to achieve a correct air-fuel ratio measurement. This problem is discussed in the specification for example at page 2, lines 6-23. To deal with the foregoing problem, the invention requires that the positions of the electrode and the gas inlet hole of the innermost cover be set apart sufficiently so that combustible unburned gas can be burned away as it flows or travels over the distance between the gas inlet hole and the electrode of the air-fuel ratio sensor. Thus, as recited in each of claims 1 and 15, the gas inlet hole of the innermost one of the plurality of cover members is spaced from the end face of the housing by a distance that is smaller than one-half of the distance from the end face of the housing to the detecting portion of the air-fuel ratio sensor.

The Yamada patent does not identify the problem addressed by the invention which occurs in particular when the sensor is disposed in a surge tank or in an exhaust manifold of a diesel engine. In the absence of recognition of or a design to address the problem noted above, Yamada does not require that the gas inlet hole be separated by

more than one-half the distance to the housing. Thus, Yamada does not identify the problem addressed by the invention nor suggest any solution for it. The Examiner has taken the position that the "specific distance between the sensor element and the inlet hole would have been an obvious matter of routine experimentation to achieve a desired flow property", referring to Figure 20 of Yamada. It is respectfully noted, however, that in connection with Figure 20, Yamada explains that the gas sensor was attached to an exhaust gas pipe of "an in-line four-cylinder injection type gasoline engine with a displacement volume of 2000 cc" (column 11, lines 50-52) and thus does not teach the combination of claim 1, wherein the sensor is disposed in an exhaust manifold of a diesel engine, nor the assembly of claim 15, wherein the sensor is disposed in a surge tank for performing measurement of an air-fuel ratio in an evaporated gas. Moreover, the plot of Figure 20 relates to a distance Z between the lower end of the gas sensing portion 19 and the lower end of inner side holes 35 in Figure 18A and describes that the gas sensing portion needs to be disposed closer to inner bottom portion 32 then the lower end of the inner side holes 25 for the gas sensor to have a fast response. However, it is evident from Figure 20 that any increase in response time when the distance Z is greater than 0 is small so that there is no teaching of approaching the relationship recited in applicant's claims. Routine experimentation cannot lead to the invention claimed in the absence of the motivation leading to the positional relation claimed. It is evident that Yamada provides no motivation to place the inlet hole(s) less than one-half the distance between the end face of the housing and the sensor portion.

In further support of the patentability of the invention, it is respectfully noted that in the design of general gas sensors (air-fuel sensor, exhaust air sensor, and the like) the size of the gas inlet hole in an inner most cover and the position of the gas inlet hole relative to an electrode (detecting portion) of the air-fuel sensor are determined in view of a response time and a water prevention performance desired. In contrast, the sensor of the invention was designed with the aim of removing by burning an unburned fuel component within a protection cover before the unburned fuel component reaches the gas detecting portion. To this end, in terms of the shape and configuration, the cover of

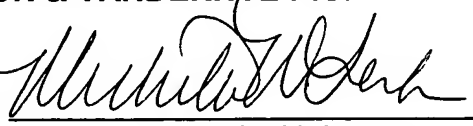
the present invention has been subjected to far more severe requirements then those involved in conventional exhaust air sensors. The shape and configuration of the cover has been determined based on a simulation of reactions of unburned fuel components occurring within the cover. The results of this simulation are shown in the attached sheet. It is therefore respectfully submitted that the shape and configuration of the cover including inlet hole placement relative to the gas detecting portion are not mere matters of routine experimentation in furtherance of the response time object of Yamada, but are directed to simulations and analyses substantially different from that of Yamada and therefore would not be the result of routine experimentation based on the teachings of Yamada. Sato does not overcome the deficiencies of Yamada in respect to the invention claimed.

Reconsideration and withdrawal of the prior art rejections is solicited.

All objections and rejections having been addressed, it is respectfully submitted that the present application is in condition for allowance and an early Notice to that effect is earnestly solicited.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: 

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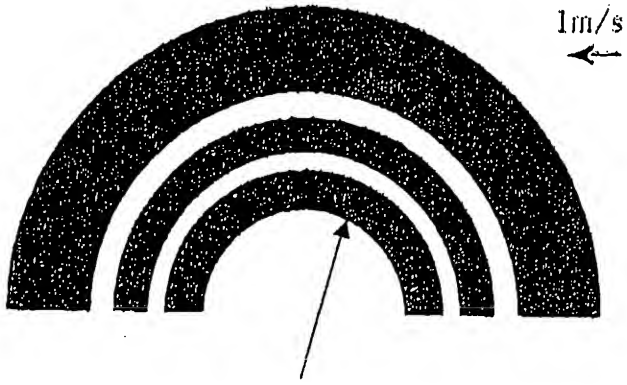
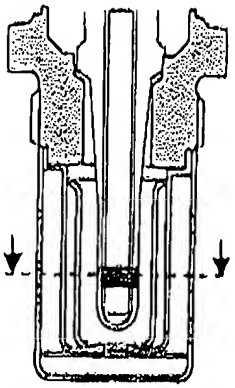
Results of Gas Flow and Reaction Simulation

Present Invention





Oxygen concentration reduced due reaction.

Oxygen Concentration